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EFFECTS OF FEEDS AND SAW SPEEDS ON COTTON TURN-OUT AND QUALITY

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Rough ginning is often caused by dense seed rolls. These dense seed rolls come from feeding cotton to the gins beyond the capacity associated with loose-roll operation or by retaining the seed within the roll box by improper manipulation of the seed board. Observations made by the engineers and cotton technologists of the Department of Agriculture since 1930 at many operating gins confirm the belief that a substantial part of the cotton crop is ginned too rapidly, but much of the alleged damage to American cotton at gins has erroneously been attributed to the speed of the gin saws, rather than to the rate of feeding.

Cotton growers who are not informed as to the damage from rapid ginning are concerned primarily with getting their cotton ginned as quickly as possible. They encourage the ginner to rush it through the gin. If a ginner does not do this, such growers are likely to go to another gin. The cotton-ginning business is highly competitive, and a ginner is inclined to follow practices that will bring him enough cotton to make it pay. Until growers in general demand quality instead of quantity ginning, the quality of the American cotton crop will continue to average lower than it should.

During the few minutes required for ginning a bale of cotton the reward of a season's efforts in planting, growing, and harvesting the crops may be cut down if the best ginning methods and practices are not used. Therefore, it is worth while to have an understanding of the speed factors in ginning and their effect on cotton quality.

There is much misunderstanding of the term "fast ginning." Many people, including some closely connected with the ginning industry, believe fast ginning means high speed of the saw. Not a few writers for farm papers, professional agricultural workers, and farmers speak of fast ginning and high saw speed as if they were the same. As a matter of fact, the number of bales ginned per hour is not in proportion to saw speed. The rapidity with which the lint is separated from the seed depends in far greater degree upon the rate at which the seed cotton is fed into the gin stand. To gin faster, a ginner allows the seed cotton to be fed into the roll box faster. This causes the seed cotton in the roll box to become more compact, so that each saw tooth removes more fibers than when the roll is not so dense. Thus, even with the seed board wide open, fast ginning results from the use of a

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tight seed roll caused by heavy feeding, whereas slow ginning results from the use of a loose seed roll caused by slow feeding.

SEED-ROLL DENSITY AND SAW-SPEED TESTS

Because the ginning time per bale, per fixed number of gin saws, has an important effect on the quality of the ginned lint and because of misunderstanding as to what influences the rate of ginning, the United States Cotton Ginning Laboratory, Stoneville, Miss., made an extensive series of tests and field surveys to determine the effect of varying seed-roll density and saw speed on certain quality elements of ginned lint and on mechanical elements of gin-stand operation.

The studies uncovered facts on the relative influence of seed-roll density and gin-saw speed on the quality of ginned lint and on the ginning capacity, power requirement, and energy consumption during ginning. They also showed the losses that may come, in the money value of the lint, as a result of tight seed-roll ginning. Brush and air-blast gins were used. They were operated at or near the manufacturers' recommended speed, and at speeds 100 revolutions per minute above, and 100 revolutions per minute below, this speed. By feeding the cotton to the gin stands at different rates, it was possible to produce both loose and tight seed rolls at each gin-saw speed.

SEED ROLLS AND FACTORS AFFECTING THEIR DENSITY

A loose seed roll generally has a hollow center, whereas a tight seed roll is solid. During rotation, loose seed rolls are whiter in color because they contain a greater proportion of fibrous material per pound of seed than the tight seed rolls. Indentation in the loose seed roll by the hand is easy; and the cotton and seed, by this action, can easily be retarded or disturbed. Tight seed rolls can hardly be disturbed by the hand during rotation, and generally their higher speed and centrifugal action causes individual seeds to be freed from the roll at the top and dance there. Tight seed rolls rotate with greater circumference and at a higher speed than loose rolls, surpassing them in speed sometimes by more than 35 percent. In an 80-saw gin operating on dry cotton, a loose seed roll contains a weight of approximately two-thirds as much seed cotton and cottonseed as a tight roll.

Dense seed rolls are produced not only by excessive feeding of cotton to gin stands, but also with slow feeding to gin stands whose vital parts are in poor mechanical condition. If the saws have been neglected and are dull or badly worn, they will not be efficient in removing the lint from the seed. The result will be denser seed rolls and "napping," or poor preparation of the lint. Similarly, inadequate doffing of the lint from the saws because of badly worn or improperly adjusted brushes in brush gins or because of a rundown air-blast system in air-blast gins will produce tighter seed rolls at a given rate of feed than with efficient doffing mechanisms. A seed board too nearly closed will prevent easy discharge of the seed from the roll box, which in turn will hinder loose seed-roll performance. Feeders are sometimes operated at such a high speed that the lowest feed setting provides too much cotton for loose seed-roll ginning.

SEED-ROLL DENSITY EFFECTS ON THE QUALITY AND VALUE OF THE LINT

Changes in seed-roll density, caused by changes in the rate of feeding seed cotton to the gin stand, have a definite effect on the quality of the ginned lint and on the mechanical operation of the gin stand. Loose-roll ginning gives the better quality cotton. The greatest effect on lint quality produced by variations in seed-roll density with a wide range of cottons was on the preparation. The staple-length differences between loose- and tight-roll samples showed a slight advantage for the loose-roll samples. Laboratory determinations of fiber lengths and variability of fiber lengths showed little relation between these elements and the seed-roll density. Grade differences due to change in seed-roll density amounted to nearly two-thirds of a grade in favor of the loose roll, as shown in figure 1.

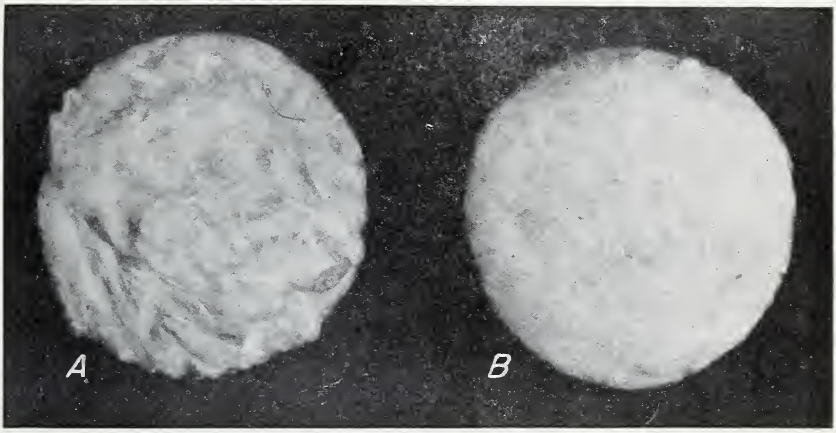

FIGURE 1.—Lint samples from same lot of seed cotton, ginned (*A*) with a tight seed roll and (*B*) with a loose seed roll.

Using 1950 Memphis prices for cotton of like grades and staples as a basis for figuring values, the use of a loose seed roll instead of a tight seed roll, with a group of cottons averaging 1$\frac{1}{16}$ inches in staple length and about 11 percent in moisture content, showed a net benefit of $5.50 or 4 percent.

The reduction in value from using a tight seed roll for short-staple cottons (about 1 inch) from seed cottons of normal moisture content averages $3 per bale.

SEED-ROLL DENSITY EFFECTS ON LINT TURN-OUT, CAPACITY, AND POWER

Lint turn-out showed no definite or consistent relationship to seed-roll density. Power requirement of the gin stand was increased approximately 50 percent by varying the seed-roll density from loose to tight, but the ginning time on a given quantity of cotton was reduced approximately 30 percent when operating with tight seed rolls resulting from fast feeding. Six pounds of fiber per 12-inch gin saw per hour is good loose-roll ginning, whereas 9 pounds of fiber per 12-inch gin saw per hour usually indicates tight seed-roll ginning. Energy consumption per unit weight of seed cotton ginned was not appreciably affected by variations in seed-roll density, because the interrelationship of ginning time and power requirements were such as to make little differences in the power used. In most instances indications favored operations with a loose seed roll. Tight seed rolls cause great wear and tear on the saws, ribs, and parts of the gin stand and chokages that sometimes delay ginning and offset any seeming advantage over loose rolls.

SAW-SPEED EFFECTS

At commercial gins the speed of the saws cannot readily be changed to increase the ginning capacity. In fact, the mechanical arrangement at practically every commercial gin is such that the speed of the saws is fixed within relatively narrow operating limits and no selective changes in speed are available, as there are in the matter of rates of feeding. To change the speed of the saws means many mechanical readjustments, including ratio of pulleys, speeds of intermediate shafting, and other items. However, representative gins across the Cotton Belt have speeded up on the average to 650 to 700 revolutions per minute to increase ginning capacity and lint turn-out.

Tests at the United States Cotton Ginning Laboratories proved conclusively that variations in gin-saw speed, within practical limits, produced much smaller effects on lint quality and ginning capacity than variations in seed-roll density. But the lint turn-out was increased, on an average, of 15 pounds per bale on short-staple and 20 pounds on long-staple cotton, with an average increase in ginning capacity of 20 percent by increasing gin-saw speed from 400 to 650 or 700 revolutions per minute on a so-called low-speed design of brush gin. The quality of the lint was generally preserved, because a loose seed roll was employed in ginning at both speeds. Bale value was also increased $3.50 on short-staple and $5.50 on long-staple cotton in the extensive tests recently completed on about 100 cottons varying widely in staple length, foreign matter, moisture content, and other conditions and qualities.

Similar tests on a high-speed-design gin with loose seed rolls showed that when the saw speed was increased to between 650 and 700 revolutions per minute, the ginning capacity was increased about 5 percent and bale weight 1 percent without changing the quality of the ginned lint.

The power requirement, though showing some tendency to increase with gin-saw speed, was not materially affected by changing the gin-saw speed 100 revolutions per minute above or below the manufacturers' recommended speed. Energy consumption per unit weight of seed cotton ginned was not appreciably affected by variations in gin-saw speed, although favorable small differences were obtained in many instances for the gin-saw speeds that were higher than the manufacturer's standard.

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